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Ralph A. Dowell of DOWELL & DOWELL P.C.
2111 Eisenhower Ave
Suite 406
Alexandria, VA 22314

EXAMINER	
LIU, LI	
ART UNIT	**PAPER NUMBER**
2613	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	10/660,799	TALEBPOUR ET AL.
	Examiner	Art Unit
	Li Liu	2613

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 September 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-81* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-81* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 September 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/18/2003*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on December 18, 2003 is being considered by the examiner.

Specification

2. The disclosure is objected to because of the following informalities:

1). Page 26 line 12, "compressor **34**" should be changed to "compressor **36**".

3). Page 67, line 10, claim 64, "**g**)" should be changed to "**k**)"; and line 13, "**h**)" should be changed to "**l**)".

3). Page 71, line 9, claim 72-iv, "in the **odd** wavelength" should be changed to "in the **even** wavelength".

Appropriate correction is required.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1-5, 7, 13-18, 20, 21, 30-34, 36, 37, 41, 46-49, 51, 52 and 59 are rejected under 35 U.S.C. 102(e) as being anticipated by Cao (US 6,731,877).

1). With regard to claim 1, Cao discloses a wavelength-division multiplexed optical communication network, comprising:

a) an optical signal transmitter (10 in Figure 1A) including,

i) an optical signal source array (RZTX in Figure 1A, and Figure 2) having at least two optical signal sources (column 7 line 20-26), each optical signal source producing optical signal pulses in a wavelength channel associated therewith (column 7 line 23-26), each of the at least two optical signal sources being optically coupled to an associated optical signal modulator (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45) for modulating the optical signal pulses that are output from the optical signal source coupled thereto to encode information onto the optical signal pulses in each wavelength channel,

ii) a multiplexer (22a – 22x in Figure 1A), each optical signal modulator having an output being optically coupled to the multiplexer for multiplexing the modulated optical signal pulses in all the wavelength channels,

iii) an optical signal pulse stretcher (26a in Figure 1A) being optically coupled to an output of the multiplexer for temporally chirping the multiplexed modulated optical signal pulses (DCE 26 adds a predetermined chirp to the associated frequency band, column 7 line 11-13);

iv) an optical fiber (the fiber between the DCE 26 and BAND MUX 28 in Figure 1A) having opposed ends being optically coupled at one of the opposed ends to an output of the optical signal pulse stretcher through which the temporally chirped multiplexed modulated optical signal pulses are transmitted; and

b) an optical signal receiver (Figure 1B) optically coupled to the optical fiber for receiving the temporally chirped multiplexed modulated optical signal pulses, the optical signal receiver including,

i) an optical signal pulse compressor (46a in Figure 1B) having an input optically coupled to the other of the opposed ends of the optical fiber (45a in Figure 1B) for temporally de-chirping the temporally chirped multiplexed modulated optical signal pulses for reconstructing the multiplexed modulated optical signal pulses (column 8 line 1-7),

ii) a demultiplexer (48a – 48x in Figure 1B) having an input optically coupled to an output of the optical signal pulse compressor for demultiplexing the reconstructed multiplexed modulated optical signal pulses to reconstruct the modulated optical signal pulses in each of the wavelength channels, and

iii) an array of optical detectors (50 in Figure 1B and Figure 7), each of the optical detectors being connected to an associated output of the demultiplexer for converting the reconstructed modulated optical signal pulses in each wavelength channel to modulated electrical signal pulses (PIN 112 in Figure 7), each optical detector including a filter (116 in Figure 7) electrically connected thereto for filtering the modulated electrical signal pulses produced therein with each filter having a predefined filter bandwidth for removing out-of-band frequency components due to four wave mixing arising from multiplexing the modulated optical signal pulses in the wavelength channels.

2). With regard to claim 2, Cao discloses wherein the optical signal modulators produce modulated optical signals pulses in a return-to-zero (RZ) format (RZTX, return-to-zero transmitters, column 6 line 38-42, and column 13 line 30).

3). With regard to claim 3, Cao discloses at least one optical amplifier (32 in Figure 1A) inserted between optical signal pulse stretcher and the optical signal pulse compressor for amplifying the temporally-chirped multiplexed modulated optical signal pulses.

4). With regard to claim 4, Cao discloses wherein the at least one optical amplifier is two optical amplifiers, an optical boost amplifier (32 in Figure 1A, the one after the BAND MUX 28) being inserted between the optical signal pulse stretcher and the optical fiber, and wherein an optical pre-amplifier (the pre-amplifier 40 in Figure 1B, column 7 line 52-53) is inserted between the optical fiber and the optical signal pulse compressor.

5). With regard to claim 5, Cao discloses wherein the two amplifiers are erbium-doped fiber amplifiers (EDFAs) (column 9 line 28-29).

6). With regard to claim 7, Cao discloses wherein the optical fiber includes at least two spans of optical fiber (one is the fiber between BAND MUX 28 and OLA 32, another is the fiber 12, Figure 1A), including at least one optical boost amplifier (32 in Figure 1A) inserted between the at least two spans of optical fiber.

7). With regard to claim 13, Cao discloses a processing means connected to the optical communication network for performing forward error correction to further

enhance the system performance (FEC Encoder in Figure 2 and FEC decoder in Figure 7).

8). With regard to claim 14, Cao discloses a wavelength-division multiplexed optical communication network (Figure 1A and 1B), comprising:

a) an optical signal transmitter (Figure 1A) including,

i) an optical signal source array (RZTX in Figure 1A, and Figure 2) having at least two optical signal sources (column 7 line 20-26), each optical signal source producing optical signal pulses in a wavelength channel associated therewith, each of the at least two optical signal sources being optically coupled to an associated optical signal modulator (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45) for modulating the optical signal pulses that are output from the optical signal source coupled thereto to encode information onto the optical signal pulses in each of the wavelength channels,

ii) each optical signal modulator (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45) being optically coupled to an input of an associated optical signal pulse stretcher (26a – 26x in Figure 1A; e.g. 20a1 coupled to 26a, 20ax coupled to 26x) for temporally chirping the modulated optical signal pulses produced in the optical signal modulator coupled thereto,

iii) a multiplexer (BAND MUX 28 in Figure 1A), each optical signal pulse stretcher (26a – 26x) including an output being optically coupled to the multiplexer for multiplexing the temporally chirped modulated optical signal pulses in all the wavelength channels;

iv) an optical fiber (the fiber between the BAND MUX 28 and OLA 32 in Figure 1A) having opposed ends being optically coupled at one of the opposed ends to an output of the multiplexer (BAND MUX 28) through which the multiplexed temporally chirped modulated optical signal pulses are transmitted; and

b) an optical signal receiver (Figure 1B) optically coupled to the optical fiber for receiving the multiplexed temporally chirped modulated optical signal pulses, the optical signal receiver including,

i) a demultiplexer (44 in Figure 1B) having an input being optically coupled to the other of the opposed ends of the optical fiber for demultiplexing the multiplexed temporally-chirped modulated optical signal pulses for reconstructing the temporally-chirped modulated optical signal pulses in each of the wavelength channels (45a-45x in Figure 1B);

ii) an array of optical signal pulse compressors (46a – 46x), each optical pulse compressor having an input optically coupled to an output of the demultiplexer (44 in Figure 1B) for temporally de-chirping the demultiplexed temporally chirped modulated optical signal pulses (from the 45a – 45x in Figure 1B) to reconstruct the modulated optical signal pulses in each of the respective wavelength channels; and

iii) an array of optical detectors (RZTX 50 in Figure 1B, and Figure 7), each optical detector being optically coupled to an output of an associated optical signal pulse compressor for converting the reconstructed modulated optical signal pulses in each wavelength channel to modulated electrical signal pulses (PIN 112 in Figure 7), each optical detector including a filter (116 in Figure 7) electrically connected thereto for

filtering the modulated electrical signal pulses with each filter having a pre-defined filter bandwidth for removing out-of-band frequency components due to four wave mixing arising from multiplexing the modulated optical signal pulses in all the wavelength channels.

9). With regard to claim 15. Cao discloses wherein the optical signal modulators produce modulated optical signals pulses in a return-to-zero (RZ) format (RZTX, return-to-zero transmitters, column 6 line 38-42, and column 13 line 30).

10). With regard to claim 16. Cao discloses that at least one optical amplifier inserted between the multiplexer and the demultiplexer for amplifying the multiplexed temporarily chirped modulated optical signal pulses (32 in Figure 1A).

11). With regard to claim 17. Cao discloses wherein the at least one optical amplifier is two optical amplifiers, an optical boost amplifier (the one after the BAND MUX 28) being optically inserted between the multiplexer and the optical fiber, and wherein an optical pre-amplifier (the pre-amplifier 40 in Figure 1B, column 7 line 52-53) is optically inserted between the optical fiber and the demultiplexer.

12). With regard to claim 18. Cao discloses wherein said two amplifiers are erbium-doped fiber amplifiers (EDFAs) (column 9 line 28-29).

13). With regard to claim 20. Cao discloses wherein the optical fiber includes at least two spans of optical fiber (one is the fiber between BAND MUX 28 and OLA 32, another is the fiber 12, Figure 1A), including at least one optical boost amplifier (32 in Figure 1A) inserted between said at least two spans of optical fiber.

14). With regard to claim 21. Cao discloses wherein including an optical boost amplifier (32 in Figure 1A) optically inserted between the multiplexer and the optical fiber in a first of the at least two spans of optical fiber, and wherein an optical pre-amplifier (40 in Figure 1B) is optically inserted between the optical fiber in a second of the at least two spans of optical fiber and the demultiplexer (44 in Figure 1B).

15). With regard to claim 30. Cao discloses a processing means connected to the optical communication network for performing forward error correction to further enhance the system performance (FEC Encoder in Figure 2 and FEC decoder in Figure 7).

16). With regard to claim 31. Cao discloses a method of suppressing four-wave mixing (column 5 line 21-36) in a wavelength-division multiplexed optical communication network, comprising the steps of:

a) generating optical signal pulses in at least two wavelength channels (RZTX in Figure 1A, and Figure 2) and modulating the optical signal pulses in each of said at least two wavelength channels for encoding information onto the optical signal pulses in each of said at least two wavelength channels (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45);

b) multiplexing (22 in Figure 1A) the modulated optical signal pulses in each of said at least two wavelength channels;

c) temporally chirping the multiplexed modulated optical signal pulses (DCE 26 in Figure 1A, DCE 26 adds a predetermined chirp to the associated frequency band, column 7 line 11-13);

d) transmitting the temporally chirped multiplexed modulated optical signal pulses through an optical fiber (12 in Figure 1A) to a receiver (Figure 1B);

e) temporally de-chirping (46 in Figure 1B) the temporally chirped multiplexed modulated optical signal pulses at the receiver optically coupled to the optical fiber for reconstructing the originally multiplexed modulated optical signal pulses;

f) demultiplexing (48 in Figure 1B) the de-chirped multiplexed modulated optical signal pulses to reconstruct the modulated optical signal pulses in each of said at least two wavelength channels;

g) detecting and converting (50 in Figure 1B and Figure 7, and PIN 112 in Figure 7) the reconstructed modulated optical signal pulses in each of said at least two wavelength channels to associated modulated electrical signal pulses; and

h) filtering (116 in Figure 7) said associated modulated electrical signal pulses to remove out-of-band high frequency components due to four wave mixing of the multiplexed modulated optical signal pulses in each of said at least two wavelength channels.

17). With regard to claim 32. Cao discloses wherein the step of modulating the optical signal pulses in each of said at least two wavelength channels includes producing modulated optical signals pulses in a return-to-zero (RZ) format (RZTX, return-to-zero transmitters, column 6 line 38-42, and column 13 line 30).

18). With regard to claim 33. Cao discloses the method including amplifying the temporally chirped multiplexed modulated optical signal pulses (32 in Figure 1A).

19). With regard to claim 34. Cao discloses wherein the temporally chirped multiplexed modulated optical signal pulses are amplified using one or more erbium-doped fiber amplifier (EDFAs) (column 9 line 28-29).

20). With regard to claim 36. Cao discloses wherein the temporally chirped multiplexed modulated optical signal pulses are amplified using two optical amplifiers, one of the two optical amplifiers being an optical boost amplifier (OLA 32, the one after the BAND MUX 28) and the other amplifier (the pre-amplifier 40 in Figure 1B, column 7 line 52-53) being an optical pre-amplifier.

21). With regard to claim 37. Cao discloses wherein the optical fiber includes at least two spans of optical fiber fiber (one is the fiber between BAND MUX 28 and OLA 32, another is the fiber 12, Figure 1A), including at least one optical boost amplifier inserted (OLA 32 in Figure 1A) between the at least two spans of optical fiber.

22). With regard to claim 41. Cao discloses wherein forward error correction is used to further enhance the system performance (FEC Encoder in Figure 2 and FEC decoder in Figure 7).

23). With regard to claim 46. Cao discloses a method of suppressing four wave mixing (column 5 line 21-36) in a wavelength-division multiplexed optical communication network, comprising the steps of:

a) generating optical signal pulses (RZTX in Figure 1A, and Figure 2) in at least two wavelength channels and modulating the optical signal pulses in each of the at least two wavelength channels for encoding information onto the optical signal pulses in each

of the at least two wavelength channels (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45);

b) temporally chirping the modulated optical signal pulses (20a1 to 20ax in Figure 1A) in each of the at least two wavelength channels (DCE 26 in Figure 1A, DCE 26 adds a predetermined chirp to the associated frequency band, column 7 line 11-13);

c) multiplexing (BAND MUX 28 in Figure 1A) the temporally chirped modulated optical signal pulses in each of the at least two wavelength channels (e.g. 20a1 and 20ax in Figure 1A);

d) transmitting the multiplexed temporally chirped modulated optical signal pulses through an optical fiber (12 in Figure 1A) to a receiver (Figure 1B);

e) demultiplexing (44 in Figure 1B) the multiplexed temporally chirped modulated optical signal pulses received at the receiver to reconstruct the temporally chirped modulated optical signal pulses in each of the at least two wavelength channels;

f) temporally de-chirping (46a to 46x in Figure 1B) the temporally chirped modulated optical signal pulses in each of the at least two wavelength channels to reconstruct the modulated optical signal pulses in each of the at least two wavelength channels;

g) detecting and converting (50 in Figure 1B and Figure 7, and PIN 112 in Figure 7) the reconstructed modulated optical signal pulses in each of the at least two wavelength channels to associated modulated electrical signal pulses; and

h) filtering filtering (116 in Figure 7) the associated modulated electrical signal pulses to remove out-of-band high frequency components due to four wave mixing of

the multiplexed modulated optical signal pulses in each of the at least two wavelength channels.

24). With regard to claim 47, Cao discloses a wherein the step of modulating the optical signal pulses in each of said at least two wavelength channels includes producing modulated optical signals pulses in a return-to-zero (RZ) format (RZTX, return-to-zero transmitters, column 6 line 38-42, and column 13 line 30).

25). With regard to claim 48, Cao discloses the method including amplifying the multiplexed temporally chirped modulated optical signal pulses (32 in Figure 1A).

26). With regard to claim 49, Cao discloses wherein the multiplexed temporally chirped modulated optical signal pulses are amplified using one or more erbium-doped fiber amplifiers (EDFAs) (column 9 line 28-29).

27). With regard to claim 51, Cao discloses wherein the multiplexed temporally chirped modulated optical signal pulses are amplified using two optical amplifiers, one of said optical amplifiers (OLA 32, the one after the BAND MUX 28) being an optical boost amplifier and the other amplifier being an optical pre-amplifier (the pre-amplifier 40 in Figure 1B, column 7 line 52-53).

28). With regard to claim 52, Cao discloses wherein the optical fiber includes at least two spans of optical fiber (one is the fiber between BAND MUX 28 and OLA 32, another is the fiber 12, Figure 1A), including at least one optical boost amplifier (OLA 32 in Figure 1A) inserted between the at least two spans of optical fiber.

29). With regard to claim 59, Cao discloses wherein forward error correction is used to further enhance the system performance (FEC Encoder in Figure 2 and FEC decoder in Figure 7).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 64-68, 70-76, 78 and 81 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877) in view of Thomas (US 6,968,132) and Bergano (US 6,134,033).

1). With regard to claim 64 and 65, Cao discloses a method of suppressing four-wave mixing (column 5 line 21-36) in a wavelength-division multiplexed optical communication network, comprising the steps of:

a) generating one set of the wavelength channels (the No "1" channels: 20a1 – 20n1 in Figure 1A, hereinafter "1" set) and modulating optical signal pulses in each of the "1" wavelength channels for encoding information onto the optical signal pulses in each of the "1" wavelength channels (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45);

b) generating another set of wavelength channels (the No "x" channels: 20ax – 20nx in Figure 1A, hereinafter "x" set) and modulating optical signal pulses in each of

the "x" wavelength channels for encoding information onto the optical signal pulses in each of the "x" wavelength channels (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45);

c) multiplexing (CHAN MUX 22a in Figure 1A) the modulated optical signal pulses in the "1" wavelength channels;

d) multiplexing (CHAN MUX 22x in Figure 1A) the modulated optical signal pulses in the "x" wavelength channels;

e) temporally chirping (26a in Figure 1A) the multiplexed modulated optical signal pulses in the "1" wavelength channels;

f) temporally chirping (26x in Figure 1A) the multiplexed modulated optical signal pulses in the "x" wavelength channels;

g) "coupling" (BAND MUX 28) the temporally chirped multiplexed modulated optical signal pulses in each of the "1" wavelength channels with the temporally chirped multiplexed modulated optical signal pulses in each of the "x" wavelength channels;

h) transmitting the coupled, temporally chirped multiplexed modulated optical signal pulses in the "1" and "x" wavelength channels through an optical fiber (12 in Figure 1A) to a receiver (Figure 1B);

i) "de-coupling" (44 in Figure 1B) the coupled, temporally chirped multiplexed modulated optical signal pulses in the "1" and "x" wavelength channels, temporally de-chirping (46a in Figure 1B) the temporally chirped multiplexed modulated optical signal pulses in the "1" wavelength channels thereby reconstructing the multiplexed modulated optical signal pulses in the set of "1" wavelength channels, temporally de-chirping (46x

in Figure 1B) the temporally chirped multiplexed modulated optical signal pulses in the "x" set wavelength channels thereby reconstructing the multiplexed modulated optical signal pulses in the set of even wavelength channels;

j) demultiplexing (48a in Figure 1B) the temporally de-chirped multiplexed modulated optical signal pulses in the set of "1" wavelength channels thereby reconstructing the modulated optical signal pulses in each of the "1" wavelength channels, demultiplexing (48x in Figure 1B) the temporally de-chirped multiplexed modulated optical signal pulses in the set of even wavelength channels thereby reconstructing the modulated even wavelength optical signal pulses in each of the "x" wavelength channels;

k) detecting and converting (50 in Figure 1B and Figure 7, and PIN 112 in Figure 7) the reconstructed modulated optical signal pulses in each of the "1" and "x" set of wavelength channels respectively to associated modulated electrical signal pulses; and

l) filtering (116 in Figure 7) the modulated electrical signal pulses associated with each wavelength channel of the odd and even set of wavelength channels to remove out-of-band high frequency components due to four wave mixing of the multiplexed modulated optical signal pulses in the odd and even sets wavelength channels.

However, Cao does not discloses that the "1" set of set of wavelength channels are **odd** wavelength channels, and the "x" set of set of wavelength channels are **even** wavelength channels; the odd and even sets are **interleaved**.;

And Cao also does not discloses wherein in steps e) and f) a chirp of selected value is applied to the multiplexed modulated optical signal pulses in each of the odd

wavelength channels and a chirp of opposite sign but the same magnitude as the selected value is applied to the multiplexed modulated optical signal pulses in each of the even wavelength channels, and wherein in step j) the step of temporally de-chirping the temporally chirped multiplexed modulated optical signal pulses in the odd set of wavelength channels includes applying a de-chirp of opposite sign to the sign of the chirp value applied to the multiplexed modulated optical signal pulses in each of the odd set of wavelength channels, and wherein in step j) the step of temporally de-chirping the temporally chirped multiplexed modulated optical signal pulses in the even set of wavelength channels includes applying a de-chirp of opposite sign to the sign of the chirp value applied to the multiplexed modulated optical signal pulses in each of the even set wavelength channels.

However, Thomas, in the same field of endeavor, teaches a method to generate two sets of channels (802 and 810 in Figure 8). The chirp ($-C_1/2$) of set of channel $\lambda_{a1} - \lambda_{an}$ (802 in Figure 8) has a opposite sign but the same magnitude as the chirp ($C_1/2$) of the set of channel $\lambda_{b1} - \lambda_{bn}$ (810 in Figure 8). And wherein the step of temporally de-chirping the temporally chirped multiplexed modulated optical signal pulses in the $\lambda_{a1} - \lambda_{an}$ set of wavelength channels includes applying a de-chirp of opposite sign ($C_1/2$) to the sign of the chirp value applied to the multiplexed modulated optical signal pulses in each of the $\lambda_{a1} - \lambda_{an}$ set of wavelength channels, and wherein in step of temporally de-chirping the temporally chirped multiplexed modulated optical signal pulses in the $\lambda_{b1} - \lambda_{bn}$ set of wavelength channels includes applying a de-chirp of opposite sign ($-C_1/2$) to

the sign of the chirp value applied to the multiplexed modulated optical signal pulses in each of the $\lambda_{b1} - \lambda_{bn}$ set wavelength channels.

And, Thomas teaches that "In similar fashion, a second set of modulated spectra 810, in this example comprising respective carrier spectra $\lambda_{b1}, \ldots, \lambda_{bn}$ that may or may not be substantially identical to those of the first set of modulated spectra 802". Therefore, the two sets of channels (802 and 810 in Figure 8) can be interleaved when λ_{a1} is similar to λ_{b1} and λ_{a2} is similar to λ_{b2} et al.

Also, Bergano et al, in the same field of endeavor, discloses a method in which the odd set of channels and even set of channels are interleaved to suppress the four-wave mixing (Figure 1 and 5, column 1 line 48-52). Although Bergano et al interleaves the two sets of channels with different of state of polarization, that is, to make the odd and even channels "orthogonal", and does not disclose that the two sets of channels have opposite signs of chirp, Bergano et al teaches the concept of interleaving and making them "orthogonal" or "opposite" so to reduce FWM.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the interleaving and opposite signs of chirp taught by Thomas and Bergano et al to the method of Cao so that the nonlinear distortion can be effectively suppressed and system performance is improved.

2). With regard to claim 66, Cao discloses all of the subject matter as applied to claims 64 and 65 above. And Cao further discloses wherein the step of modulating the optical signal pulses in each of the odd and even set of wavelength channels includes

producing modulated optical signals pulses in a return-to-zero (RZ) format (RZTX, return-to-zero transmitters, column 6 line 38-42, and column 13 line 30).

3). With regard to claim 67, Cao discloses all of the subject matter as applied to claims 64-66 above. And Cao further discloses the method including amplifying the interleaved temporally chirped multiplexed modulated optical signal pulses (32 in Figure 1A).

4). With regard to claim 68, Cao discloses all of the subject matter as applied to claims 64-67 above. And Cao further discloses wherein the temporally chirped multiplexed modulated optical signal pulses are amplified using one or more erbium-doped fiber amplifier (EDFAs) (column 9 line 28-29).

5). With regard to claim 70, Cao discloses all of the subject matter as applied to claims 64-67 above. And Cao further discloses wherein the temporally chirped multiplexed modulated optical signal pulses are amplified using two optical amplifiers, one of the two optical amplifiers being an optical boost amplifier (OLA 32, the one after the BAND MUX 28) and the other amplifier being an optical pre-amplifier (the pre-amplifier 40 in Figure 1B, column 7 line 52-53).

6). With regard to claim 71, Cao discloses all of the subject matter as applied to claims 64-67 above. And Cao further discloses wherein the optical fiber includes at least two spans of optical fiber (one is the fiber between BAND MUX 28 and OLA 32, another is the fiber 12, Figure 1A), including at least one optical boost amplifier (OLA 32 in Figure 1A) inserted between the at least two spans of optical fiber.

7). With regard to claim 72, Cao discloses a wavelength-division multiplexed optical communication network, comprising:

a) an optical signal transmitter (Figure 1A) including,

i) an optical signal source array (20 in Figure 1A) having

a first array (20a1 – 20n1 in Figure 1A, the "1" set of channel) of optical signal sources for producing optical signal pulses in at least two wavelength channels (the "1" set has n channels: 20a1 – 20n1), each of the optical signal sources in the first array of optical signal sources being optically coupled to an associated optical signal modulator for modulating the optical signal pulses that are output from the optical signal source coupled thereto to encode information onto the optical signal pulses in each of the "1" wavelength channels (RZTX, return-to-zero transmitters, column 6 line 38-42, and 68 in Figure 2, column 8 line 20-45);

a second array (20ax – 20nx in Figure 1A, the "x" set of channel) of optical signal sources for producing optical signal pulses in at least two "x" labeled wavelength channels (the "x" set has n channels: 20ax – 20nx in Figure 1A), each of the optical signal sources in the second array of optical signal sources being optically coupled to an associated optical signal modulator for modulating the optical signal pulses that are output from the optical signal source coupled thereto to encode information onto the optical signal pulses in each of the "x" wavelength channels;

ii) a first multiplexer (CHAN MUX 22a in Figure 1A), each optical signal modulator connected to the optical signal sources in the first array of optical signal sources having an output which is optically coupled to the first multiplexer for

multiplexing the modulated optical signal pulses in the "1" wavelength channels, a second multiplexer (CHAN MUX 22x in Figure 1A), each optical signal modulator connected to the optical signal sources in the second array of optical signal sources having an output which optically coupled to the second multiplexer for multiplexing the modulated optical signal pulses in the "x" wavelength channels;

iii) a first optical signal pulse stretcher (26a in Figure 1A) being optically coupled to an output of the first multiplexer for temporally chirping the multiplexed modulated optical signal pulses in the "1" wavelength channels, a second optical signal pulse stretcher (26x in Figure 1A) being optically coupled to an output of the second multiplexer for temporally chirping the multiplexed modulated optical signal pulses in the "x" wavelength channels;

iv) an optical signal pulse "coupler" (BAND MUX 28) optically coupled to an output of each of the first and second multiplexors for interleaving the temporally chirped multiplexed modulated optical signal pulses in the "1" wavelength channels with the temporally chirped multiplexed modulated optical signal pulses in the "x" wavelength channels;

v) an optical fiber (the fiber between BAND MUX 28 and OLA 32 in Figure 1A) having opposed ends being optically coupled at one of the opposed ends to an output of the "coupler" (28 in Figure 1A) through which the coupled, temporally chirped multiplexed modulated optical signal pulses from the "1" and "x" wavelength channels are transmitted; and

b) an optical signal receiver (Figure 1B) for receiving the interleaved temporally chirped multiplexed modulated optical signal pulses from the "1" and "x" wavelength channels, the optical signal receiver including,

i) an optical signal pulse "de-coupler" (44 in Figure 1B) being optically coupled to the other of the opposed ends of the optical fiber for "de-coupling" the "coupled", temporally chirped multiplexed modulated optical signal pulses from the "1" and "x" wavelength channels,

ii) a first optical signal pulse compressor (46a in Figure 1B) being optically coupled to a first output of the "de-coupler" for temporally de-chirping the multiplexed modulated optical signal pulses in the "1" wavelength channels, a second optical signal pulse compressor (46x in Figure 1B) being optically coupled to a second output of the "de-coupler" for temporally de-chirping the multiplexed modulated optical signal pulses in the "x" wavelength channels;

iii) a first demultiplexer (48a in Figure 1B) having an input optically coupled to an output of the first optical signal pulse compressor for demultiplexing the reconstructed multiplexed modulated optical signal pulses in the "1" wavelength channels to reconstruct the modulated optical signal pulses in each of the odd wavelength channels, a second demultiplexer (48x in Figure 1B) having an input optically coupled to an output of the second optical signal pulse compressor for demultiplexing the reconstructed multiplexed modulated optical signal pulses in the even wavelength channels to reconstruct the modulated optical signal pulses in each of the "x" wavelength channels,

iv) a first array of first optical detectors (50a1 – 50n1 in Figure 1B), each of the first optical detectors being connected to an associated output of the first demultiplexer for converting the reconstructed modulated optical signal pulses in the "1" wavelength channels to modulated electrical signal pulses (50 in Figure 1B and Figure 7, and PIN 112 in Figure 7), each of the first optical detectors having an associated filter (116 in Figure 7) electrically connected thereto for filtering the modulated electrical signal pulses produced therein with each filter having a predefined filter bandwidth for removing out-of-band frequency components due to four wave mixing arising from multiplexing the modulated optical signal pulses in the "1" wavelength channels, a second array of second optical detectors (50ax – 50nx in Figure 1B), each of the second optical detectors being connected to an associated output of the second demultiplexer for converting the reconstructed modulated optical signal pulses in the even wavelength channels to modulated electrical signal pulses (50 in Figure 1B and Figure 7, and PIN 112 in Figure 7), each of the second optical detectors having an associated filter (116 in Figure 7) electrically connected thereto for filtering the modulated electrical signal pulses produced therein with each filter having a predefined filter bandwidth for removing out-of-band frequency components due to four wave mixing arising from multiplexing the modulated optical signal pulses in the "x" wavelength channels.

However, Cao does not discloses that the "1" set of set of wavelength channels are **odd** wavelength channels, and the "x" set of set of wavelength channels are **even**

wavelength channels; the odd and even sets are **interleaved** by a **interleaver**, and de-interleaved by a de-interleaver

And Cao also does not discloses that the second optical signal pulse stretcher applying a temporal chirp to the multiplexed modulated optical signal pulses in the even wavelength channels which is of **opposite sign** to a temporal chirp applied to the multiplexed modulated optical signal pulses in the odd wavelength channels by the first optical signal pulse stretcher; and the first optical signal pulse compressor with a temporal chirp of **opposite sign** to the temporal chirp applied by the first optical signal pulse stretcher for reconstructing the multiplexed modulated optical signal pulses in the odd wavelength channels; the second optical signal pulse compressor with a temporal chirp of **opposite sign to** the temporal chirp applied by the second optical signal pulse stretcher for reconstructing the multiplexed modulated optical signal pulses in the even wavelength channels.

However, Thomas, in the same field of endeavor, teaches a method to generate two sets of channels (802 and 810 in Figure 8). The chirp ($-C_1/2$) of set of channel $\lambda_{a1} - \lambda_{an}$ (802 in Figure 8) has a opposite sign but the same magnitude as the chirp ($C_1/2$) of the set of channel $\lambda_{b1} - \lambda_{bn}$ (810 in Figure 8). And wherein the step of temporally de-chirping the temporally chirped multiplexed modulated optical signal pulses in the $\lambda_{a1} - \lambda_{an}$ set of wavelength channels includes applying a de-chirp of opposite sign ($C_1/2$) to the sign of the chirp value applied to the multiplexed modulated optical signal pulses in each of the $\lambda_{a1} - \lambda_{an}$ set of wavelength channels, and wherein in step of temporally de-chirping the temporally chirped multiplexed modulated optical signal pulses in the $\lambda_{b1} -$

λ_{bn} set of wavelength channels includes applying a de-chirp of opposite sign ($-C_1/2$) to the sign of the chirp value applied to the multiplexed modulated optical signal pulses in each of the $\lambda_{b1} - \lambda_{bn}$ set wavelength channels.

And, Thomas teaches that "In similar fashion, a second set of modulated spectra 810, in this example comprising respective carrier spectra $\lambda_{b1}, \ldots, \lambda_{bn}$ that may or may not be substantially identical to those of the first set of modulated spectra 802". Therefore, the two sets of channels (802 and 810 in Figure 8) can be interleaved when λ_{a1} is similar to λ_{b1} and λ_{a2} is similar to λ_{b2} et al.

Also, Bergano et al, in the same field of endeavor, discloses a method in which the odd set of channels and even set of channels are interleaved to suppress the four-wave mixing (Figure 1 and 5, column 1 line 48-52). Although Bergano et al interleaves the two sets of channels with different of state of polarization, that is, to make the odd and even channels "orthogonal", and does not disclose that the two sets of channels have opposite signs of chirp, Bergano et al teaches the concept of interleaving and making them "orthogonal" or "opposite" so to reduce FWM.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the interleaving and opposite signs of chirp taught by Thomas and Bergano et al to the method of Cao so that the nonlinear distortion can be effectively suppressed and system performance is improved.

8). With regard to claim 73, Cao discloses all of the subject matter as applied to claim 72 above. And Cao further discloses wherein the optical signal modulators

produce modulated optical signals pulses in a return-to-zero (RZ) format (RZTX, return-to-zero transmitters, column 6 line 38-42, and column 13 line 30).

9). With regard to claim 74, Cao discloses all of the subject matter as applied to claims 72 and 73 above. And Cao further discloses the optical communication network including at least one optical amplifier (32 in Figure 1A) inserted between optical signal pulse interleaver and the optical signal pulse de-interleaver for amplifying the temporally-chirped multiplexed modulated optical signal pulses.

10). With regard to claim 75, Cao discloses all of the subject matter as applied to claims 72-74 above. And Cao further discloses wherein the at least one optical amplifier is two optical amplifiers, an optical boost amplifier (the one after the BAND MUX 28) being inserted between the optical signal pulse interleaver and the optical fiber, and wherein an optical pre-amplifier (the pre-amplifier 40 in Figure 1B, column 7 line 52-53) is inserted between the optical fiber and the optical signal pulse de-interleaver.

11). With regard to claim 76, Cao discloses all of the subject matter as applied to claims 72-75 above. And Cao further discloses wherein the two amplifiers are erbium-doped fiber amplifiers (EDFAs) (column 9 line 28-29).

12). With regard to claim 78, Cao discloses all of the subject matter as applied to claims 72 and 73 above. And Cao further discloses wherein the optical fiber includes at least two spans of optical fiber (one is the fiber between BAND MUX 28 and OLA 32, another is the fiber 12, Figure 1A), including at least one optical boost amplifier (OLA 32 in Figure 1A) inserted between the at least two spans of optical fiber.

13). With regard to claim 81, Cao discloses all of the subject matter as applied to claims 72 and 73 above. And Cao further discloses the optical communication network including processing means connected to the optical communication network for performing forward error correction to further enhance the system performance (FEC Encoder in Figure 2 and FEC decoder in Figure 7).

7. Claims 6, 19, 35, 50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877).

Cao discloses all of the subject matter as applied to claims 1-4, 14-17, 31-33 and 46-48 above. And Cao also discloses a Raman amplifier (34 in Figure 1B). But Cao does not explicitly disclose wherein the two amplifiers are semiconductor optical amplifiers (SOAs) or Raman amplifiers. However, such limitations are merely a matter of design choice and would have been obvious in the system of Cao. Cao teaches the using of EDFA or Raman amplifiers. The limitations in claims 6, 19, 35, 50 do not define a patentably distinct invention over that in Cao since both the invention as a whole and Cao are directed to amplify the signal. Therefore, to use an EDFA or SOA or Raman amplifiers would have been a matter of obvious design choice to one of ordinary skill in the art.

8. Claims 69 and 77 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877) and Thomas (US 6,968,132) and Bergano (US 6,134,033) as applied to claims 64-67 and 72-75 above.

Cao in view of Thomas and Bergano discloses all of the subject matter as applied to claims 64-67 and 72-75 above. And Cao also discloses a Raman amplifier (34 in Figure 1B). But Cao does not explicitly disclose wherein the two amplifiers are semiconductor optical amplifiers (SOAs) or Raman amplifiers. However, such limitations are merely a matter of design choice and would have been obvious in the system of Cao. Cao teaches the using of EDFA or Raman amplifiers. The limitations in claims 69 and 77 do not define a patentably distinct invention over that in Cao since both the invention as a whole and Cao are directed to amplify the signal. Therefore, to use an EDFA or SOA or Raman amplifiers would have been a matter of obvious design choice to one of ordinary skill in the art.

9. Claims 8-10, 22, 25-27, 38-40, 53-55 and 58 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877) in view of Thomas (US 6,968,132) and Bickham (US 6,782,175).

1). With regard to claims 8, 25, 38, and 58. Cao discloses all of the subject matter as applied to claims 1-2, 14-15, 31-32 and 46-47 above. But Cao does not explicitly state that wherein the optical signal pulse stretcher applies a **linear chirp** of given slope to the modulated optical signal pulses, and wherein the optical pulse compressor applies a linear chirp to the temporally chirped modulated optical signal pulses which has a slope of opposite sign to the given slope.

It is well known and textbook knowledge that linear chirped pulse is easy to manipulated or compensated. Such linear chirp pulse is used by Thomas in the optical network (Figure 2 and Figure 4, column 4 line 22-26), and the optical pulse compressor

applies a linear chirp to the temporally chirped modulated optical signal pulses which has a slope of opposite sign to the given slope (Figure 2, 4 and 8, column 4 line 22-26)

And Bickham teaches "Dispersion causes broadening in transmitted optical pulses due to the difference in transmission speeds of light at different wavelengths. Because the pulse is broadened, the power density is decreased over the pulse, and thus optical effects which are non-linear in power density are reduced" (column 1 line 18-27).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the linear chirp, temporally broadened and peak power decreased pulse taught by Thomas and Bickham to the system of Cao so that the nonlinear distortion can be effectively suppressed and system performance is improved.

2). With regard to claim 9, 26, 39, 53, Cao discloses all of the subject matter as applied to claims 1-2, 14-15, 31-32 and 46-47 above. And Cao further discloses wherein the optical fiber includes at least two spans of optical fiber (one is the fiber between 24a and DCE 26a, another is the fiber between 26a and BAND MUX 28, Figure 1A), and including an optical dispersive element (DCE 26 in Figure 1A) inserted between the at least two spans of optical fiber.

But Cao does not explicitly discloses the signs of the dispersion elements or that the optical dispersive element is inserted for **reverses a sign** of the temporal chirp applied to the optical signal pulses in each wavelength channel, and wherein the optical

pulse compressor has an appropriate magnitude and sign to substantially reconstruct the optical signal pulses.

However, Thomas discloses an optical dispersive element reverses a sign of the temporal chirp applied to the optical signal pulses in each wavelength channel (the Data stream 1 has a negative chirp $-C_1/2$, 406 in Figure 4, the Data stream 2 has a positive chirp $+C_1/2$, 414 in Figure 4), and wherein the optical pulse compressor has an appropriate magnitude and sign to substantially reconstruct the optical signal pulses (the Data stream 1 is compensated by a positive DM $C_1/2$, 420 in Figure 4, the Data stream 2 is compensated a negative DM chirp $-C_1/2$, 424 in Figure 4).

Also Bickham teaches "Dispersion causes broadening in transmitted optical pulses due to the difference in transmission speeds of light at different wavelengths. Because the pulse is broadened, the power density is decreased over the pulse, and thus optical effects which are non-linear in power density are reduced" (column 1 line 18-27).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply oppositely chirped, temporally broadened and peak power decreased pulses taught by Thomas and Bickham to the system of Cao so that the nonlinear distortion can be effectively suppressed and system performance is improved.

3). With regard to claim 10, 27, 40 and 54, Cao discloses all of the subject matter as applied to claims 1, 2, 9, 14,15, 26, 31, 32, 39, 46, 47, 53 above. And Cao further

discloses at least one optical boost amplifier inserted between the at least two spans of optical fiber (OLA 32 in Figure 1A).

4). With regard to claims 22 and 55, Cao discloses all of the subject matter as applied to claims 14,15, and 46, 47 above. But, Cao does not explicitly disclose wherein a sign of the temporal chirp applied by the optical signal pulse stretchers may vary on a per wavelength channel basis, wherein for a given wavelength channel, a sign of the temporal chirp of the compressor is chosen to be opposite to that applied by the corresponding stretcher to the given wavelength channel.

However, Thomas, in the same field of endeavor, teaches a system and method in which a sign of the temporal chirp applied by the optical signal pulse stretchers (DM 506, 534 and 508 et al in Figure 5, column 5 line 7-15) in may vary on a per wavelength channel basis, wherein for a given wavelength channel, a sign of the temporal chirp of the compressor (DM 516, 536 and 518 et al in Figure 5, column 5 line 31-36) is chosen to be opposite to that applied by the corresponding stretcher to the given wavelength channel.

Also Bickham teaches "Dispersion causes broadening in transmitted optical pulses due to the difference in transmission speeds of light at different wavelengths. Because the pulse is broadened, the power density is decreased over the pulse, and thus optical effects which are non-linear in power density are reduced"(column 1 line 18-27).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply oppositely chirped, temporally broadened and

peak power decreased pulses taught by Thomas and Bickham to the system of Cao so that the nonlinear distortion can be effectively suppressed and system performance is improved.

10. Claims 23 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877) and Thomas (US 6,968,132) and Bickham (US 6,782,175) as applied to 14,15, 22, and 46, 47, 55 above, and in further view of Bergano (US 6,134,033).

Cao in view of Thomas and Bickham disclose all of the subject matter as applied to claims 14,15, 22, and 46, 47, 55 above. But, Cao in view of Thomas and Bickham does not explicitly disclose wherein the optical signal pulse stretchers and optical signal pulse compressors apply alternating values of positive and negative chirp, so that adjacent wavelength channels have opposite chirp signs when propagating through the optical fiber.

Thomas teaches the method to generate two sets of channels (802 and 810 in Figure 8). The chirp ($-C_1/2$) of the set of channel $\lambda_{a1} - \lambda_{an}$ (802 in Figure 8) has an opposite sign but the same magnitude as the chirp ($C_1/2$) of the set of channel $\lambda_{b1} - \lambda_{bn}$ (810 in Figure 8). And, Thomas teaches that "In similar fashion, a second set of modulated spectra 810, in this example comprising respective carrier spectra $\lambda_{b1}, \ldots,$ λ_{bn} that may or may not be substantially identical to those of the first set of modulated spectra 802". Therefore, the two sets of channels (802 and 810 in Figure 8) can be interleaved when λ_{a1} is similar to λ_{b1} and λ_{a2} is similar to λ_{b2} et al, and then the stretchers and compressors apply alternating values of positive and negative chirp.

And, Bergano et al, in the same field of endeavor, discloses a method in which the odd set of channels and even set of channels are interleaved to suppress the four-wave mixing (Figure 1 and 5, column 1 line 48-52). Although Bergano et al interleaves the two sets of channels with different of state of polarization, that is, to make the odd and even channels "orthogonal", and does not disclose that the two sets of channels have opposite signs of chirp, Bergano et al teaches the concept of interleaving and making them "orthogonal" or "opposite" so to reduce FWM.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the interleaving and opposite signs of chirp taught by Thomas and Bergano et al to the method of Cao and Bickham so that the nonlinear distortion can be effectively suppressed and system performance is improved.

11. Claims 24 and 57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877) as applied to 14,15 and 46, 47 above, and in view of Liang et al (US 2003/0011839).

Cao discloses all of the subject matter as applied to claims 14,15, and 46, 47 above. And Cao discloses wherein each optical signal pulse stretcher for temporally chirping the optical signal pulses has the same chirp value (Note that if all pulse stretcher of each channels has the same chirp value, one of ordinary skill in the art will recognize that only one stretcher is needed to stretch the pulses of the multiplexed channels, this is what Cao discloses in Figure 1A, 26a, so to reduce cost). But, Cao do not explicitly disclose wherein each optical signal pulse compressor for temporally de-

chirping the optical signal pulses applies a different chirp value to offset effects of chromatic dispersion of the optical transmission medium on each wavelength channel.

However, Liang et al, in the same field of endeavor, discloses a dispersion compensation arrangement in which each optical signal pulse compressor for temporally de-chirping the optical signal pulses applies a different chirp value to offset effects of chromatic dispersion of the optical transmission medium on each wavelength channel (37 in Figure 3, [0027] or page 4, left column, line 29-31), so to improve the system performance (ABSTRACT and [0027]).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the method of compensating of individual channels taught by Liang et al to the system and method of Cao and Thomas and Bickham so that the pulses of individual channels can efficiently compressed, the nonlinear distortion can be effectively suppressed and system performance can be improved.

12. Claim 11, 12, 28, 29, 42-45, 60-63 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877) in view of Bergano (US 6,137,604).

Cao discloses all of the subject matter as applied to claims 1, 2, 14, 15, 31, 32, 46 and 47 above. Cao further discloses wherein the optical signal pulse stretcher (DCE 24 in Figure 1A) having a chromatic dispersion value chosen in such a way that the optical pulses are stretched by an appropriate amount (a predetermined chirp, column 7 line 11-13), and wherein the optical signal pulse compressor (46 in Figure 1B) having a

chromatic dispersion value chosen in such a way that the optical pulses are compressed by an appropriate amount (dispersion compensation, column 8 line 1-7).

But Cao does not disclose wherein the optical signal pulse stretcher (chirping) includes a chirped **fiber Bragg grating** or a segment of **dispersive optical fiber** optically coupled to an optical branch device, and wherein the optical signal pulse compressor (de-chirping) includes a chirped **fiber Bragg grating** or a segment of **dispersive optical fiber**.

However, the fiber Bragg grating and dispersive optical fiber have been widely used as the dispersion element in optical communication, such fiber grating and dispersive optical fiber are disclosed by Bergano (column 4, line 1-2 and 27-29, and Figure 7, column 6 line 22-23).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the fiber Bragg grating or dispersive optical fiber taught by Bergano to the system of Cao so that an alternative linear chirp element can be used, and the nonlinear distortion can be effectively suppressed and system performance is improved.

13. Claims 79 and 80 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cao (US 6,731,877) and Thomas (US 6,968,132) and Bergano (US 6,134,033) as applied to claims 72 and 73 above, and in further view of Bergano (US 6,137,604)

Cao in view of Thomas and Bergano (US '033) discloses all of the subject matter as applied to claims 72 and 73 above. Cao discloses wherein the optical signal pulse stretcher (DCE 24 in Figure 1A) having a chromatic dispersion value chosen in such a

way that the optical pulses are stretched by an appropriate amount (a predetermined chirp, column 7 line 11-13), and wherein the optical signal pulse compressor (46 in Figure 1B) having a chromatic dispersion value chosen in such a way that the optical pulses are compressed by an appropriate amount (dispersion compensation, column 8 line 1-7).

But Cao does not disclose wherein the optical signal pulse stretcher (chirping) includes a chirped **fiber Bragg grating** or a segment of **dispersive optical fiber** optically coupled to an optical branch device, and wherein the optical signal pulse compressor (de-chirping) includes a chirped **fiber Bragg grating** or a segment of **dispersive optical fiber**.

However, the fiber Bragg grating and dispersive optical fiber have been widely used as the dispersion element in optical communication, such fiber grating and dispersive optical fiber are disclosed by Bergano (US '604) (column 4, line 1-2 and 27-29, and Figure 7, column 6 line 22-23).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the fiber Bragg grating or dispersive optical fiber taught by Bergano to the system of Cao and Thomas and Bergano (US '033) so that an alternative linear chirp element can be used, and the nonlinear distortion can be effectively suppressed and system performance is improved.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Darcie (US 6,014,479) discloses a system and method to reduces or eliminate FWM noise, while allowing very small wavelength separation between the channels in a low dispersion transmission fiber. The method combines a chirped WDM source with a particular fiber dispersion map that prevents interchannel overlap and minimizes four-wave mixing noise throughout transmission.

Bakhshi et al (US 2004/0208605) discloses a method and apparatus for chromatic dispersion compensation to reduce the severity of non-linear penalties.

Starori (US 2004/0067032) discloses a dispersion-managed optical soliton transmission system to reduce the FWM.

Shake et al (US 6,587,242) discloses a pre-broadening method that suppresss the peak intensity of the optical light to reduce the FWM.

Sekine et al (Sekine et al: "10Gbit/s four-channel WDM transmission experiment over 500km technique for suppressing four-wave mixing", ELECTRNOIC LETTERS, July 7, 1994, Vol. 30, No. 14, page 1150-1151) demonstrates a WDM transmission with technique for suppression FWM by arranging the dispersion values of the fibers along the transmission line.

Murakami et al (Murakami et al: "Long-Haul WDM Transmission Using Higher Order Fiber Dispersion Management", Journal of Lightwave Technology, Vol. 18, No. 9,

September 2000, page 1197-1204) proposes a dispersion management scheme to reduce the FWM.

Inoue et al (Inoue et al: "Pre-spread RZ pulse transmission for reducing intra-channel nonlinear interactions", LEOS 2000 Annual Meeting, Rio Grande, Puerto Rico, Paper MJ3 (Nov. 2000), page 92-93) discloses a pre-spread pulse transmission for reducing the FWM.

Neokosmidis et al (Neokosmidis et al: "New Techniques for the Suppression of the Four-Wave Mixing-Induced Dispersion in Nonzero Dispersion Fiber WDM Systems", Journal of Lightwave Technology, Vol. 28, No. 3, March 2005, page 1137-1144) discloses an optical prechirp to reduce the FWM.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Li Liu whose telephone number is (571)270-1084. The examiner can normally be reached on Mon-Fri, 8:00 am - 5:30 pm, alternating Fri off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ken Vanderpuye can be reached on (571)272-3078. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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KENNETH VANDERPUYE
SUPERVISORY PATENT EXAMINER

Li Liu
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